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It is easily seen that when the same proportion of alcohol to water prevails, the contents of the alcohol in the first vessel will be $=a^2/(a+b)$.

$\therefore x$ must be $=\infty$.

II. Solution by G. B. M. ZERR. A. M., Ph. D.. Parsons, W. Va.

After the first operation, there are $a-c$ gallons of alcohol in the first vessel, and c gallons of alcohol in the second vessel. After the second operation, there are $a-2c+c^2(1/a+1/b)$ gallons of alcohol in the first vessel, and $2c-c^2(1/a+1/b)$ gallons of alcohol in the second vessel.

Let $A=c(1/a+1/b)$. Then, after the third operation, there are $a-3c+3Ac-A^2c$ gallons of alcohol in the first vessel, and $3c-3Ac+A^2c$ gallons of alcohol in the second vessel. After the n th operation there are

$$a-nc + \frac{n(n-1)}{2!}Ac - \frac{n(n-1)(n-2)}{3!}A^2c + \dots \pm A^{n-1}c = a + \frac{c(1-A)^n - c}{A} \text{ gallons of}$$

alcohol, and $\frac{c-c(1-A)^n}{A}$ gallons of water in the first vessel, and

$$nc - \frac{n(n-1)}{2!}Ac + \frac{n(n-1)(n-2)}{3!}A^2c - \dots \pm A^{n-1}c = \frac{c-c(1-A)^n}{A} \text{ gallons of alco-}$$

hol, and $b + \frac{c(1-A)^n - c}{A}$ gallons of water in the second vessel.

$$\therefore \frac{Aa + c(1-A)^n - c}{c - c(1-A)^n} = \frac{c - c(1-A)^n}{Ab + c(1-A)^n - c}.$$

$$\therefore (1-A)^n = \frac{c(a+b) - Aab}{c(a-b)} = 0. \quad \therefore n = -\infty, \text{ or } A = 1.$$

\therefore The result stated can only happen when $a=b=2c$, then $n=1$.

156. Proposed by R. D. CARMICHAEL, Hartselle, Ala.

There exist no multiply perfect odd numbers of multiplicity n containing only n distinct primes.

Solution by JACOB WESTLUND, Ph. D., Purdue University, Lafayette, Ind.

If n denotes the multiplicity of a multiply perfect number $p_1^{a_1} p_2^{a_2} \dots p_i^{a_i}$, where p_1, p_2, \dots are distinct primes, we have

$$n = \frac{p_1 - \frac{1}{p_1^{a_1}}}{p_1 - 1} \cdot \frac{p_2 - \frac{1}{p_2^{a_2}}}{p_2 - 1} \dots, \text{ and hence } n < \frac{p_1}{p_1 - 1} \cdot \frac{p_2}{p_2 - 1} \dots \frac{p_i}{p_i - 1}.$$

Now, if $p_1 > 2$, we have

$$\frac{p_1}{p_1-1} \cdot \frac{p_2}{p_2-1} \cdots \frac{p_i}{p_i-1} \leq \frac{3}{2} \cdot \frac{4}{3} \cdots \frac{i+2}{i} = \frac{i+2}{2}.$$

Hence we should have $n < \frac{i+2}{2}$, or $i > 2n-1$.

PROBLEMS FOR SOLUTION.

ALGEBRA.

256. Proposed by THEODORE L. DeLAND, Treasury Department, Washington, D. C.

Three men, A, B, and C, rented a pasture for a fixed amount, each to pay per month in proportion to the stock pastured. During the first month A put in 3 horses and B and C each some horses, and B paid for the month \$6, but A and C each defaulted payment. During the next month each put in one more horse, and C paid for the month \$7.20, but A and B each defaulted payment. During the next month each put in one more horse, and A paid his bill for the month, \$5, but B and C each defaulted.

Required: (1) the rent of the pasture per month; (2) the number of horses B and C each put in during the first month; and (3) the amount A, B, and C, each, owed for the unpaid service.

257. Proposed by L. E. NEWCOMB, Los Gatos, Cal.

Solve (1) $x+y=10$, (2) $3x=\log_{10}y$.

258. Proposed by R. D. CARMICHAEL, Hartselle, Ala.

Sum the infinite series $\frac{n^2}{(4n^2-1)^2}$ beginning with $n=1$, n being always odd.

CALCULUS.

216. Proposed by R. D. CARMICHAEL, Hartselle, Ala.

Find the limit of the sum of the series

$$\frac{n}{n^2+1^2} + \frac{n}{n^2+2^2} + \frac{n}{n^2+3^2} + \cdots + \frac{n}{n^2+m^2},$$

when n and m are indefinitely increased. (Distinguish the several cases arising from the different *relative* values of m and n .)

217. Proposed by S. A. COREY, Hiteman, Iowa.

In *The Analyst*, Vol. II, p. 120, 1875, G. W. Hill finds by the method of mechanical quadrature the value of $\int_0^{\frac{\pi}{2}} \frac{x dx}{\sin x [1+1.16 \cos^2 x]^{\frac{3}{2}}}$ to be 1.6576363.

Evaluate the definite integral by some other method and verify above result.